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Liu et al.

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(54) **OBJECT COUNTING DEVICE, OBJECT COUNTING SYSTEM AND OBJECT COUNTING METHOD**

(71) Applicant: **VIVOTEK INC.**, New Taipei (TW)

(72) Inventors: **Cheng-Chieh Liu**, New Taipei (TW); **Szu-Mo Chang**, New Taipei (TW); **Chih-Yen Lin**, New Taipei (TW)

(73) Assignee: **VIVOTEK INC.**, New Taipei (TW)

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(51) **Int. Cl.**
G06K 9/00 (2006.01)

(52) **U.S. Cl.**
CPC ***G06K 9/00778*** (2013.01); *G06T 2207/30232* (2013.01); *G06T 2207/30242* (2013.01)

(58) **Field of Classification Search**
None
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

2004/0238628 A1* 12/2004 Clark G07C 9/00 235/382
2014/0333769 A1* 11/2014 Shibuya H04N 7/183 348/148

FOREIGN PATENT DOCUMENTS

TW 200727204 7/2007

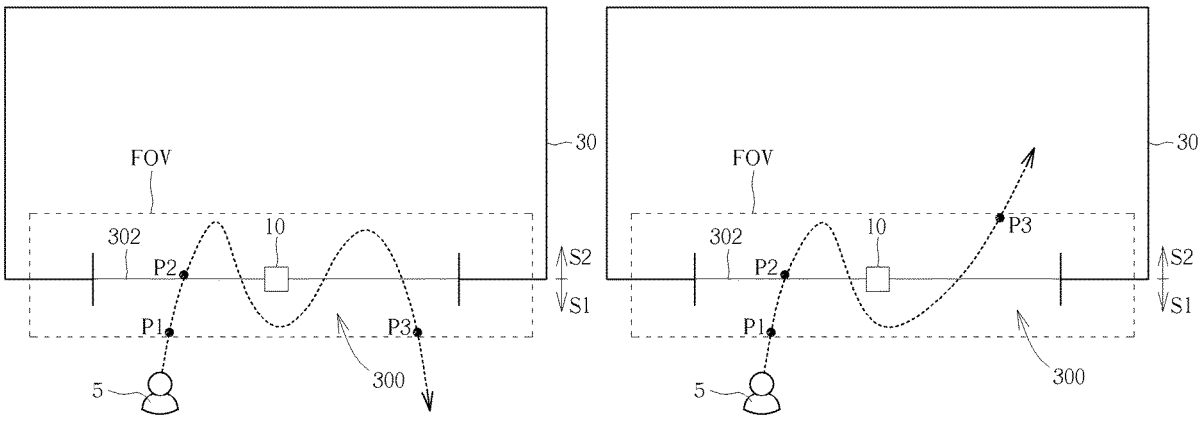
* cited by examiner

Primary Examiner — Justin P. Misleh
(74) *Attorney, Agent, or Firm* — Winston Hsu

(57) **ABSTRACT**

An object counting device includes an image capturer and a processor. The image capturer captures an image sequence related to a gate within a field of view. When an object in the image sequence passes through an entry/exit reference corresponding to the gate, the processor determines a moving direction of the object. When the processor determines that the object moves from a first side of the gate towards a second side of the gate, the processor counts the object into a first accumulated number. When the object exits from the field of view, the processor records an exit position of the object. The processor determines whether to count the object into a second accumulated number according to the exit position.

13 Claims, 8 Drawing Sheets



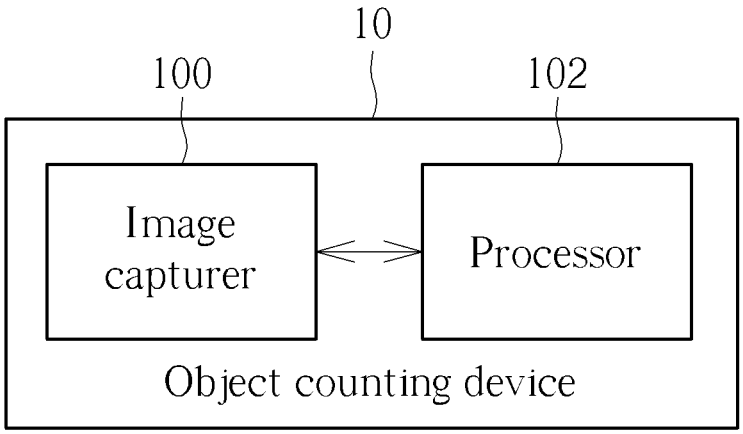

10
100
102
Image capturer
Processor
Object counting device

FIG. 1

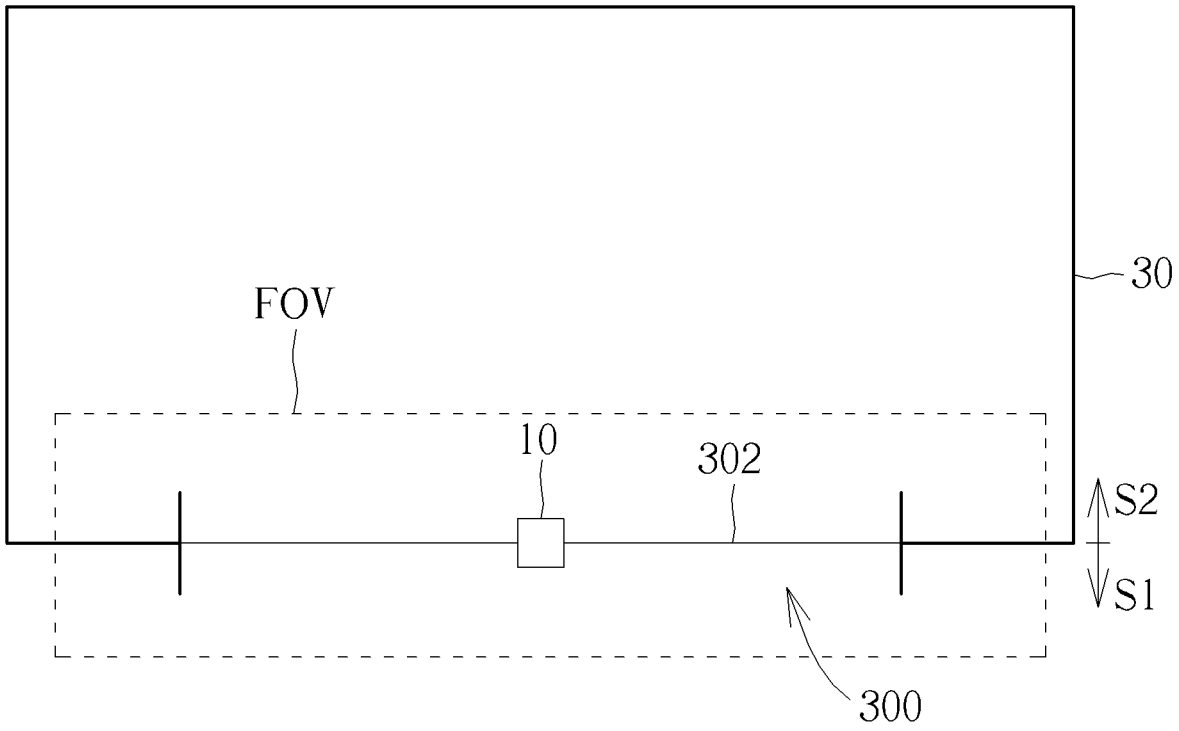

30
FOV
10
302
S2
S1
300

FIG. 2

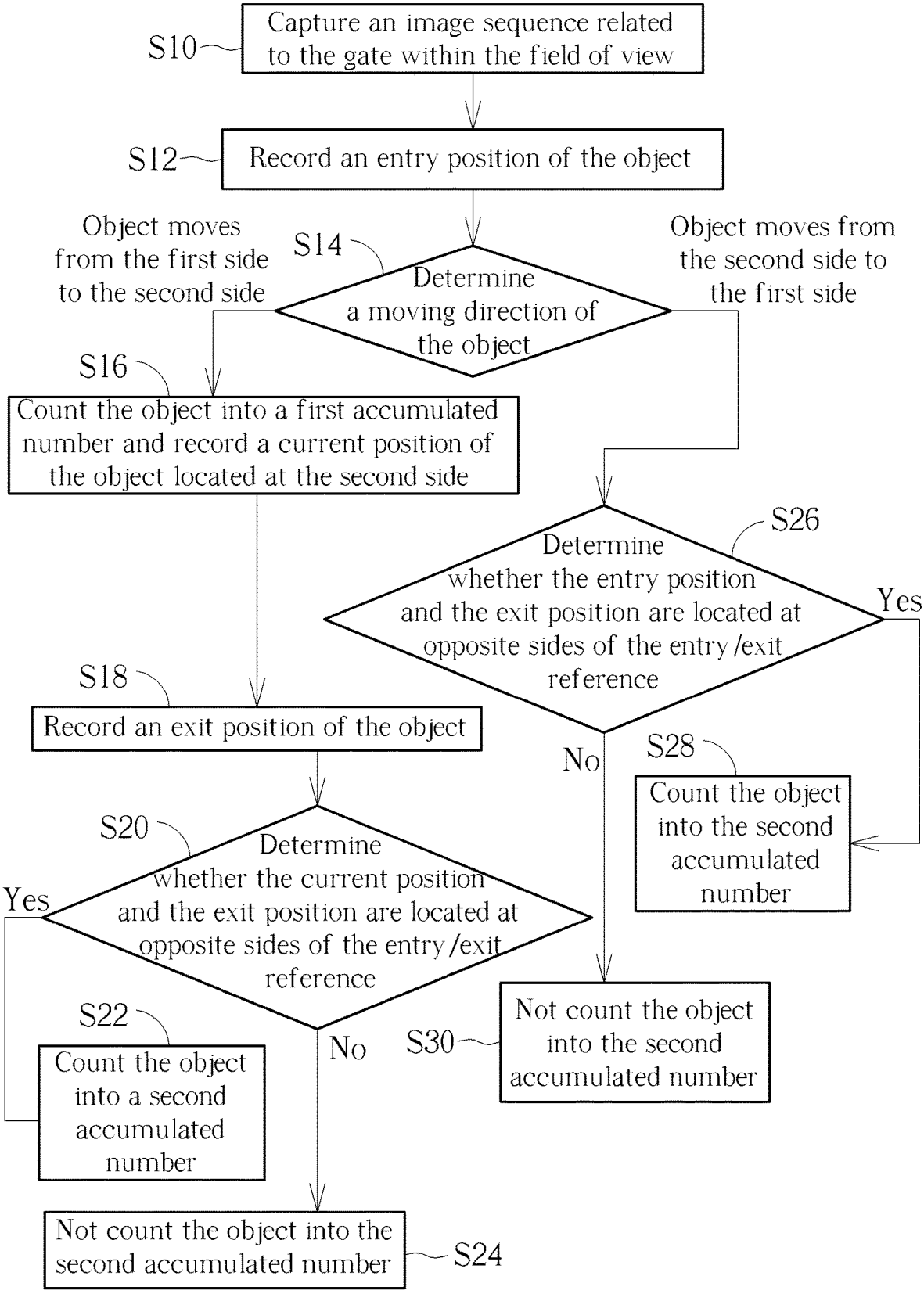

S10
Capture an image sequence related to the gate within the field of view
S12
Record an entry position of the object
S14
Determine a moving direction of the object
Object moves from the first side to the second side
Object moves from the second side to the first side
S16
Count the object into a first accumulated number and record a current position of the object located at the second side
S26
Determine whether the entry position and the exit position are located at opposite sides of the entry/exit reference
Yes
No
S18
Record an exit position of the object
S28
Count the object into the second accumulated number
S20
Determine whether the current position and the exit position are located at opposite sides of the entry/exit reference
Yes
No
S22
Count the object into a second accumulated number
S30
Not count the object into the second accumulated number
Not count the object into the second accumulated number
S24

FIG. 3

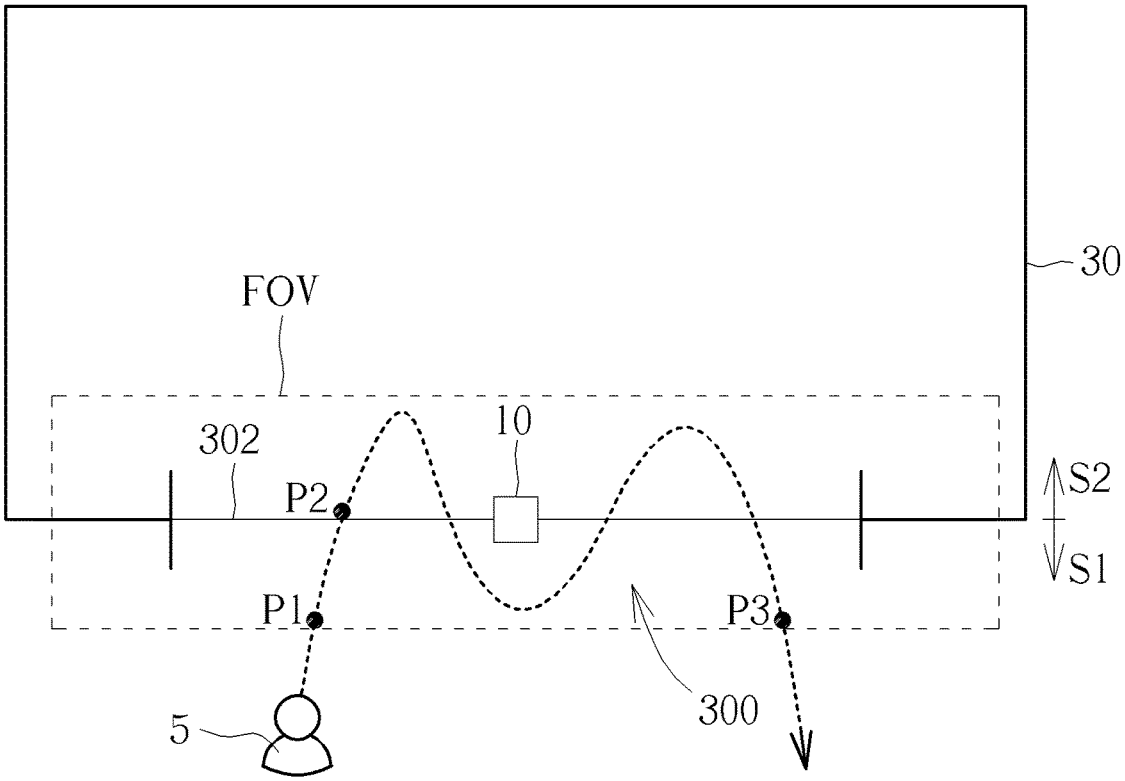


FIG. 4

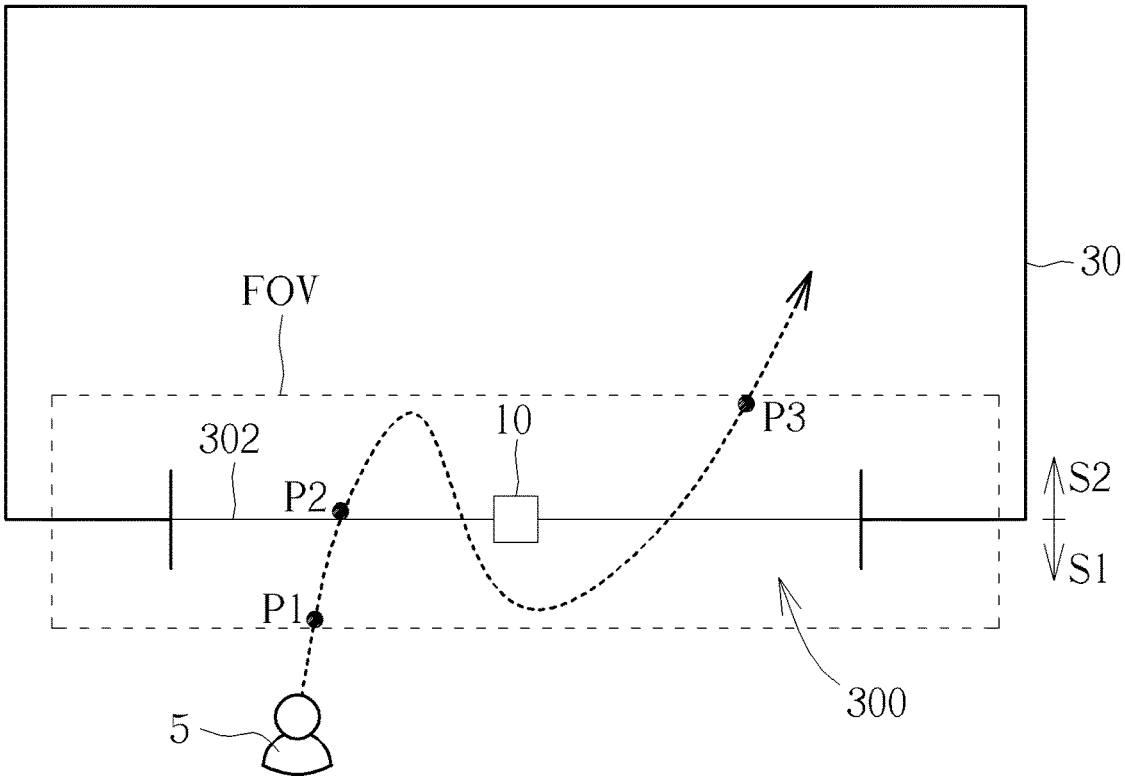


FIG. 5

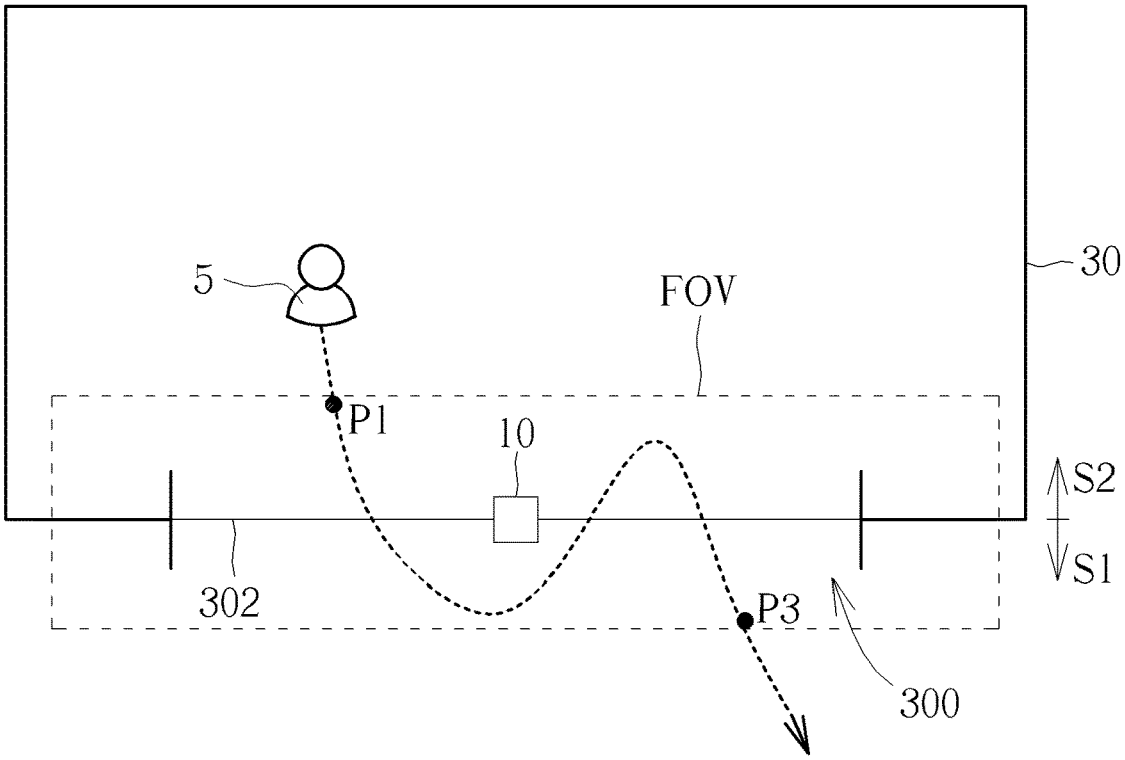


FIG. 6

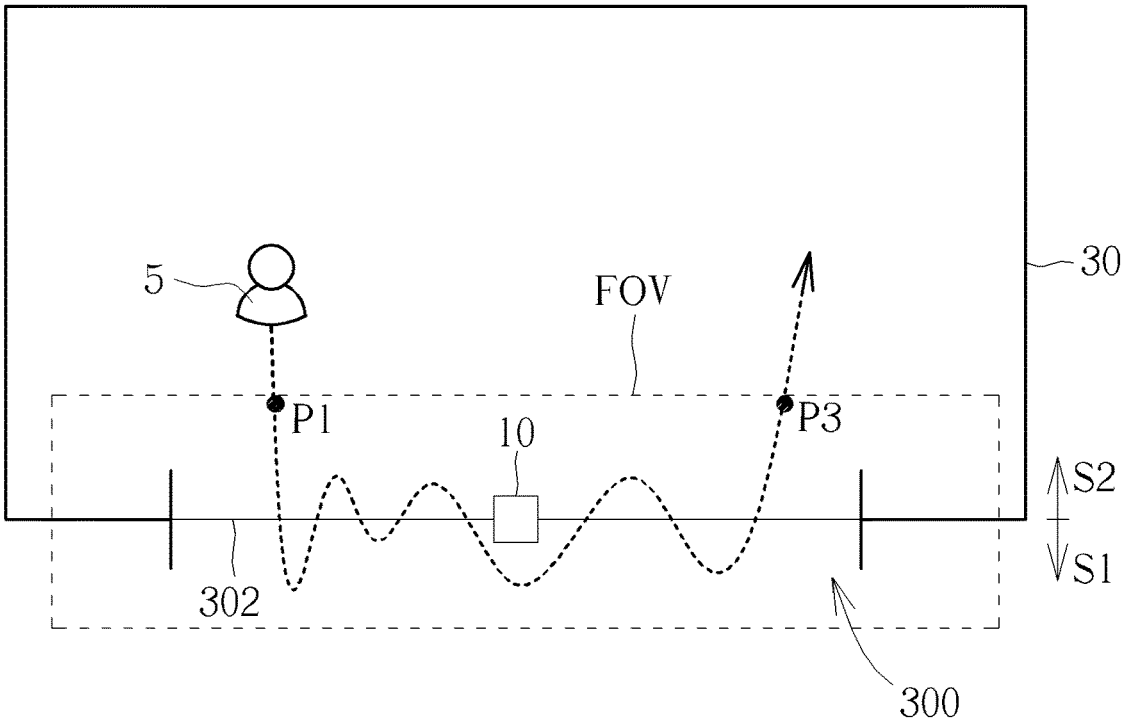


FIG. 7

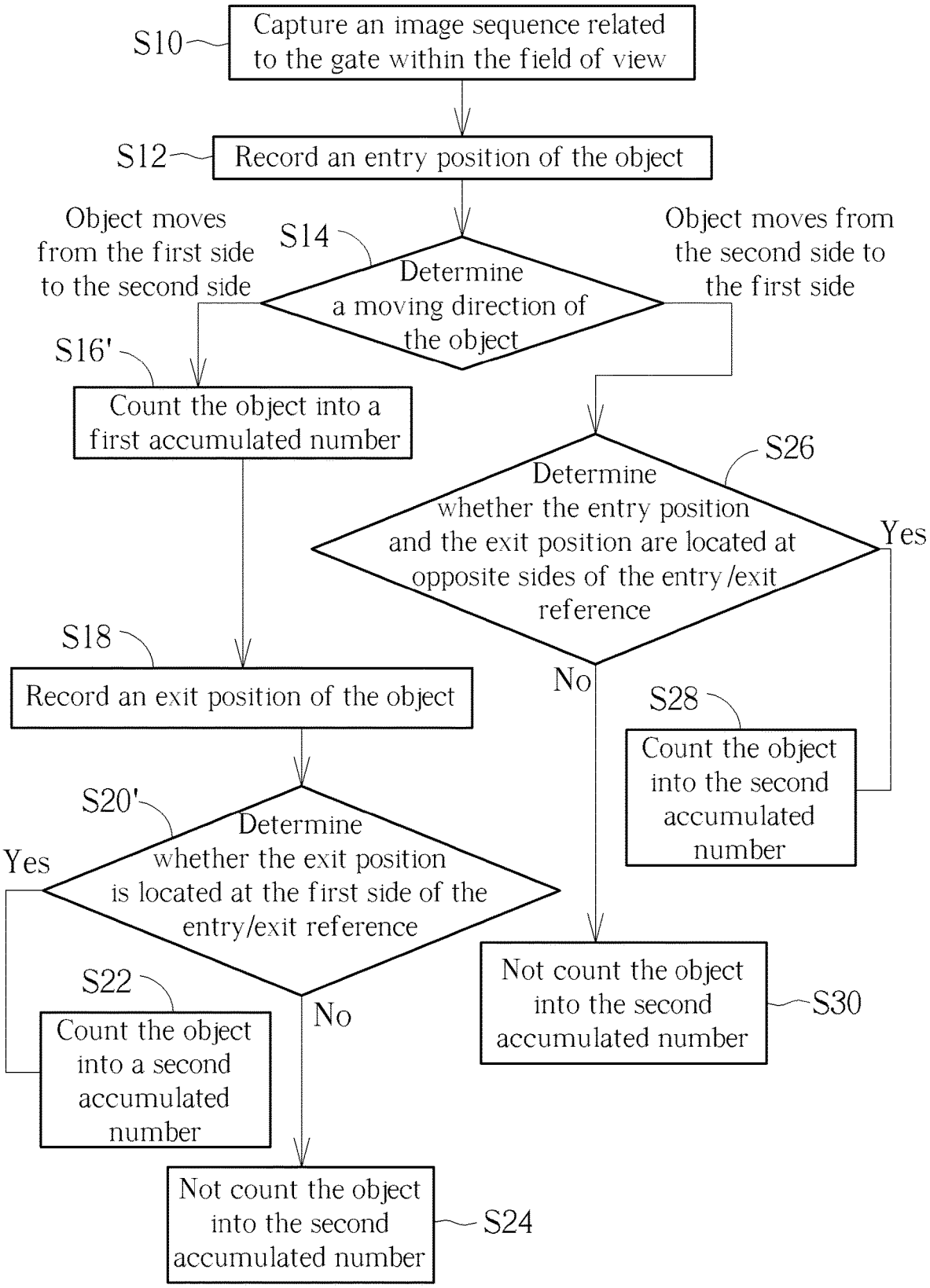

S10
Capture an image sequence related to the gate within the field of view
S12
Record an entry position of the object
S14
Determine a moving direction of the object
Object moves from the first side to the second side
Object moves from the second side to the first side
S16'
Count the object into a first accumulated number
S18
Record an exit position of the object
S20'
Determine whether the exit position is located at the first side of the entry/exit reference
Yes
No
S22
Count the object into a second accumulated number
Not count the object into the second accumulated number
S24
S26
Determine whether the entry position and the exit position are located at opposite sides of the entry/exit reference
Yes
No
S28
Count the object into the second accumulated number
Not count the object into the second accumulated number
S30

FIG. 8

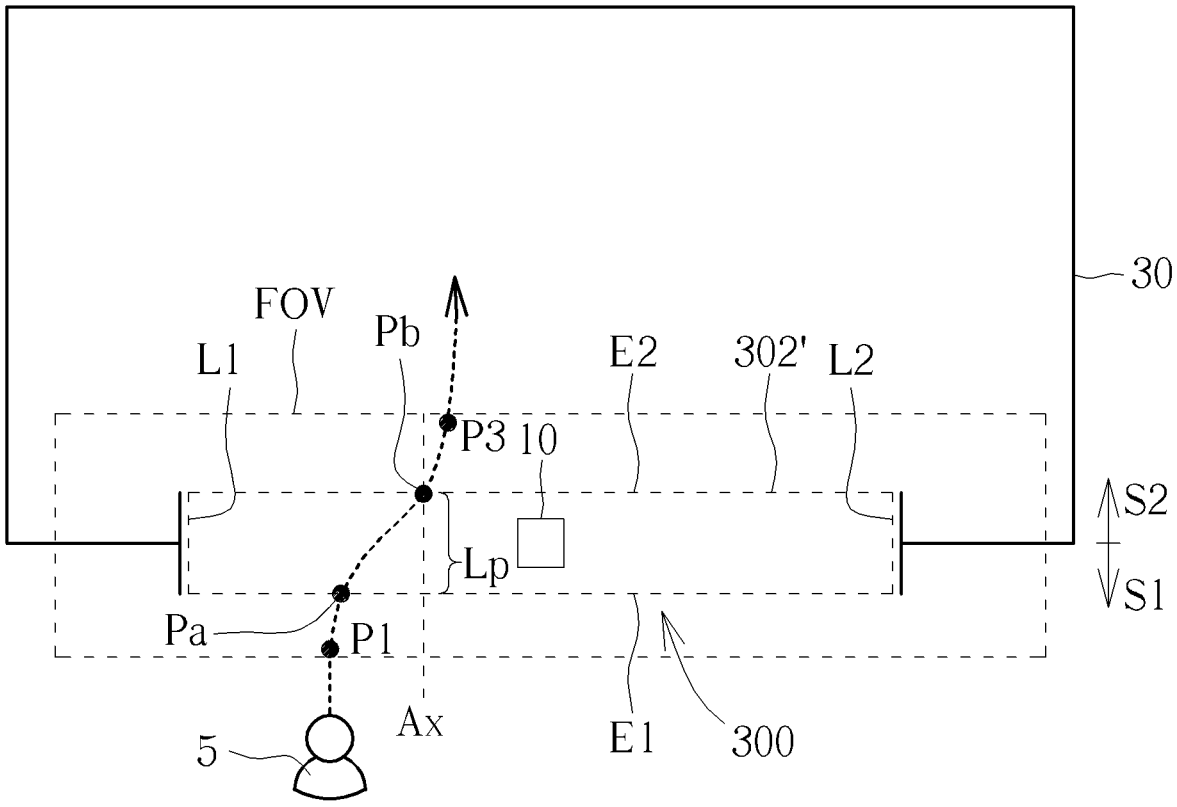


FIG. 9

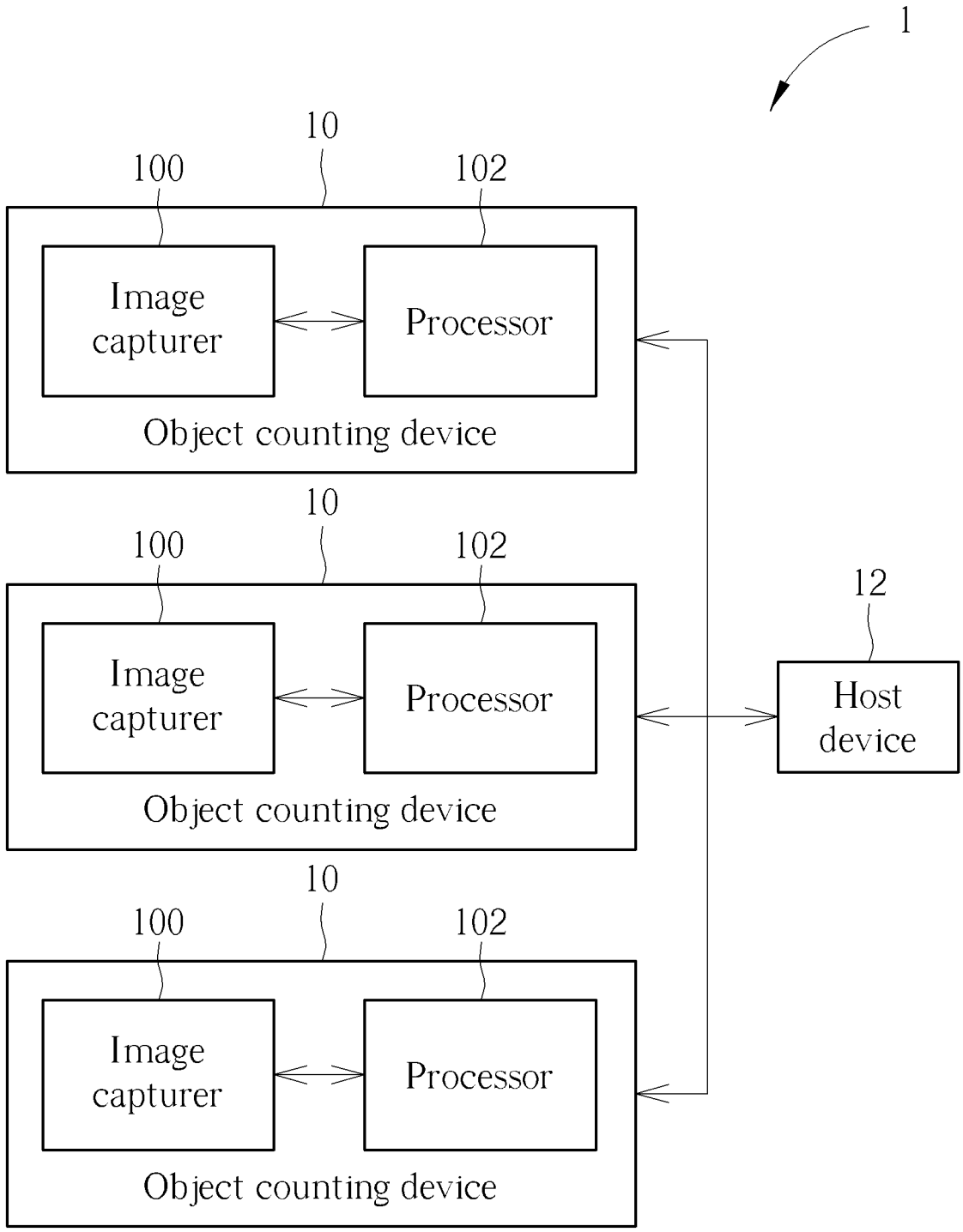

1
10
100
102
Image capturer
Processor
Object counting device
10
100
102
Image capturer
Processor
Object counting device
12
Host device
10
100
102
Image capturer
Processor
Object counting device

FIG. 10

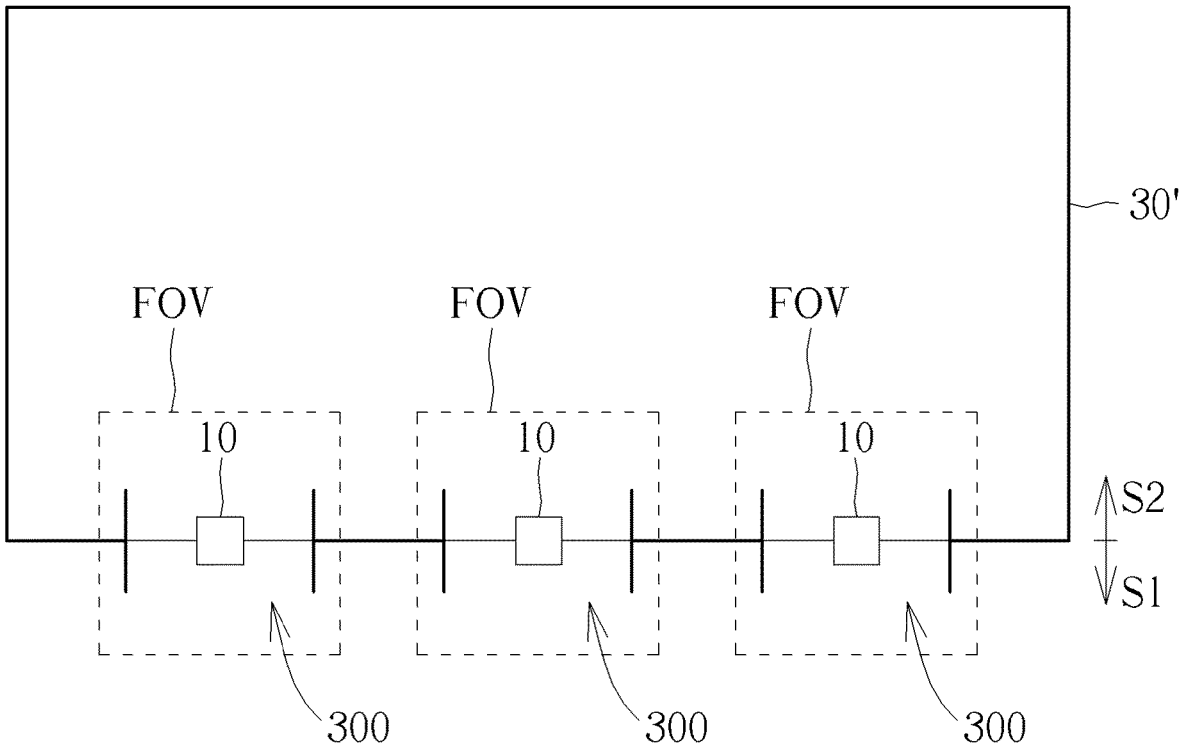


FIG. 11

OBJECT COUNTING DEVICE, OBJECT COUNTING SYSTEM AND OBJECT COUNTING METHOD

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to an object counting device, an object counting system and an object counting method and, more particularly, to an object counting device, an object counting system and an object counting method for determining the timing of counting an object according to a moving direction of the object.

2. Description of the Prior Art

With the advent of the era of big data, it has a tendency to use and analyze objective data to review or enhance service quality and operating efficiency of a specific site. Some sites have used cameras to track customers, so as to count the number of customers who enter or exit from the sites. Specifically, when some goods are placed around a gate of a store, the timing of counting the customers who enter or exit from the gate should be different, so as to improve the accuracy of counting the number of customers who enter or exit from the store. Furthermore, for public transportation (e.g. bus), the timing of counting the customers who enter or exit from the gate should also be different, so as to improve the accuracy of counting the number of customers who enter or exit from the public transportation.

SUMMARY OF THE INVENTION

An objective of the invention is to provide an object counting device, an object counting system and an object counting method for determining the timing of counting an object according to a moving direction of the object, so as to solve the aforesaid problems.

According to an embodiment of the invention, the object counting device comprises an image capturer and a processor. The image capturer captures an image sequence related to a gate within a field of view. The processor is electrically connected to the image capturer. The processor determines a moving direction of an object when the object in the image sequence passes through an entry/exit reference corresponding to the gate. The processor counts the object into a first accumulated number when the processor determines that the object moves from a first side of the gate towards a second side of the gate. The processor records an exit position of the object when the object exits from the field of view. The processor determines whether to count the object into a second accumulated number according to the exit position.

According to another embodiment of the invention, an object counting system comprises a plurality of object counting devices and a host device. Each of the object counting devices comprises an image capturer and a processor. The image capturer captures an image sequence related to a gate within a field of view. The processor is electrically connected to the image capturer. The processor determines a moving direction of an object when the object in the image sequence passes through an entry/exit reference corresponding to the gate. The processor counts the object into a first accumulated number when the processor determines that the object moves from a first side of the gate towards a second side of the gate. The processor records an exit position of the object when the object exits from the field of view. The processor determines whether to count the object into a second accumulated number according to the exit position. The host device communicates with the object counting devices. The host device receives a plurality of the first accumulated numbers and a plurality of the second accumulated numbers from the object counting devices, calculates a first sum of the first accumulated numbers, and calculates a second sum of the second accumulated numbers.

According to another embodiment of the invention, an object counting method comprises steps of capturing an image sequence related to a gate within a field of view; determining a moving direction of an object when the object in the image sequence passes through an entry/exit reference corresponding to the gate; counting the object into a first accumulated number when determining that the object moves from a first side of the gate towards a second side of the gate; recording an exit position of the object when the object exits from the field of view; and determining whether to count the object into a second accumulated number according to the exit position.

As mentioned in the above, when the object in the image sequence passes through the entry/exit reference corresponding to the gate, the invention determines the moving direction of the object first and then determines the timing of counting the object according to the moving direction of the object. Accordingly, the invention can improve the accuracy of counting the number of customers who enter or exit from a specific site (e.g. store, public transportation, etc.) effectively.

These and other objectives of the present invention will no doubt become obvious to those of ordinary skill in the art after reading the following detailed description of the preferred embodiment that is illustrated in the various figures and drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a functional block diagram illustrating an object counting device according to an embodiment of the invention.

FIG. **2** is a schematic diagram illustrating the object counting device shown in FIG. **1** being disposed at a gate of a site.

FIG. **3** is a flowchart illustrating an object counting method according to an embodiment of the invention.

FIG. **4** is a schematic diagram illustrating an object moving with respect to the gate.

FIG. **5** is another schematic diagram illustrating the object moving with respect to the gate.

FIG. **6** is another schematic diagram illustrating the object moving with respect to the gate.

FIG. **7** is another schematic diagram illustrating the object moving with respect to the gate.

FIG. **8** is a flowchart illustrating an object counting method according to another embodiment of the invention.

FIG. **9** is a schematic diagram illustrating an entry/exit reference according to another embodiment of the invention.

FIG. **10** is a functional block diagram illustrating an object counting system according to another embodiment of the invention.

FIG. **11** is a schematic diagram illustrating a plurality of object counting devices shown in FIG. **10** being disposed at a plurality of gates of a site.

DETAILED DESCRIPTION

Referring to FIGS. **1** and **2**, FIG. **1** is a functional block diagram illustrating an object counting device **10** according

to an embodiment of the invention and FIG. **2** is a schematic diagram illustrating the object counting device **10** shown in FIG. **1** being disposed at a gate **300** of a site **30**.

As shown in FIG. **1**, the object counting device **10** comprises an image capturer **100** and a processor **102**, wherein the processor **102** is electrically connected to the image capturer **100**. In this embodiment, the object counting device **10** may be a camera. In practical applications, the image capturer **100** may be a charge-coupled device (CCD) sensor or a complementary metal-oxide semiconductor (CMOS) sensor; the processor **102** may be a processor or a controller with data processing/calculating function. In general, the object counting device **10** may be further equipped with some necessary hardware or software components for specific purposes, such as a circuit board, a power supply, applications, a communication module, a lens, etc., and it depends on practical applications.

As shown in FIG. **2**, the object counting device **10** may be disposed at a gate **300** of a site **30**, so as to capture an image sequence related to the gate **300** within a field of view FOV of the object counting device **10**. In practical applications, the site **30** may be a store, a public transportation or other sites, which need to count the number of objects entering or exiting from the sites. Furthermore, an entry/exit reference **302** is defined at the gate **300**. In this embodiment, the entry/exit reference **302** is, but not limited to, a boundary line. Moreover, opposite sides of the gate **300** are defined as a first side S**1** and a second side S**2**. In this embodiment, the first side S**1** of the gate **300** is the outside of the site **30** and the second side S**2** of the gate **300** is the inside of the site **30**. However, in another embodiment, the first side S**1** of the gate **300** may be the inside of the site **30** and the second side S**2** of the gate **300** may be the outside of the site **30** according to practical applications.

Referring to FIGS. **3** to **7**, FIG. **3** is a flowchart illustrating an object counting method according to an embodiment of the invention, FIG. **4** is a schematic diagram illustrating an object **5** moving with respect to the gate **300**, FIG. **5** is another schematic diagram illustrating the object **5** moving with respect to the gate **300**, FIG. **6** is another schematic diagram illustrating the object **5** moving with respect to the gate **300**, and FIG. **7** is another schematic diagram illustrating the object **5** moving with respect to the gate **300**. The object counting method shown in FIG. **3** can be applied to the object counting device **10** shown in FIG. **1**.

When the object counting device **10** performs the object counting method, first, the image capturer **100** captures an image sequence related to the gate **300** within the field of view FOV (step S**10** in FIG. **3**). In this embodiment, after capturing the image sequence, the processor **102** may analyze the image sequence by an image analyzing technology to determine whether an object (e.g. human, animal or other objects) exists in the image sequence. If an object exists in the image sequence, the processor **102** may further analyze a moving trajectory and a position of the object in the image sequence by the image analyzing technology. As shown in FIGS. **4** to **7**, when an object **5** enters the field of view FOV, the processor **102** records an entry position P**1** of the object **5** (step S**12** in FIG. **3**).

When the object **5** in the image sequence passes through the entry/exit reference **302** corresponding to the gate **300** within the field of view FOV first time, the processor **102** determines a moving direction of the object **5** (step S**14** in FIG. **3**). As shown in FIGS. **4** and **5**, when the object **5** in the image sequence passes through the entry/exit reference **302** corresponding to the gate **300** within the field of view FOV first time, the processor **102** determines that the moving direction of the object **5** is from the first side S**1** of the gate **300** towards the second side S**2** of the gate **300**. As shown in FIGS. **6** and **7**, when the object **5** in the image sequence passes through the entry/exit reference **302** corresponding to the gate **300** within the field of view FOV first time, the processor **102** determines that the moving direction of the object **5** is from the second side S**2** of the gate **300** towards the first side S**1** of the gate **300**. It should be noted that since the entry/exit reference **302** is a boundary line, the invention can determine that the object **5** has passed through the entry/exit reference **302** when the object **5** crosses the entry/exit reference **302**.

As shown in FIGS. **4** and **5**, when the processor **102** determines that the object **5** moves from the first side S**1** of the gate **300** towards the second side S**2** of the gate **300**, the processor **102** counts the object **5** into a first accumulated number and records a current position P**2** of the object **5** located at the second side S**2** (step S**16** in FIG. **3**). In this embodiment, since the first side S**1** of the gate **300** is the outside of the site **30** and the second side S**2** of the gate **300** is the inside of the site **30**, it means that the object **5** enters the site **30** from the outside to the inside when the object **5** passes through the entry/exit reference **302** within the field of view FOV first time. Accordingly, the aforesaid first accumulated number may be an accumulated entry number of the site **30**.

Furthermore, when the processor **102** counts the object **5** into the first accumulated number, the processor **102** may make a mark to indicate that the object **5** has been counted into the first accumulated number. Accordingly, the invention can prevent the object **5** from being counted into the first accumulated number repeatedly when the object **5** passes through the entry/exit reference **302** within the field of view FOV back and forth.

When the object **5** exits from the field of view FOV, the processor **102** records an exit position P**3** of the object **5** (step S**18** in FIG. **3**). Then, the processor **102** determines whether the current position P**2** and the exit position P**3** are located at opposite sides of the entry/exit reference **302** (step S**20** in FIG. **3**). When the processor **102** determines that the current position P**2** and the exit position P**3** are located at opposite sides of the entry/exit reference **302**, the processor **102** counts the object **5** into a second accumulated number (step S**22** in FIG. **3**). When the processor **102** determines that the current position P**2** and the exit position P**3** are located at an identical side of the entry/exit reference **302**, the processor **102** does not count the object **5** into the second accumulated number (step S**24** in FIG. **3**). Since the first side S**1** of the gate **300** is the outside of the site **30** and the second side S**2** of the gate **300** is the inside of the site **30**, it means that the object **5** exits from the site **30** when the object **5** exits from the field of view FOV shown in FIG. **4**. Accordingly, the aforesaid second accumulated number may be an accumulated exit number of the site **30**.

As shown in FIG. **4**, since the current position P**2** and the exit position P**3** are located at opposite sides of the entry/exit reference **302** (i.e. the object **5** has exited from the site **30**), the processor **102** will count the object **5** into the second accumulated number. On the other hand, as shown in FIG. **5**, since the current position P**2** and the exit position P**3** are located at an identical side of the entry/exit reference **302** (i.e. the object **5** has not exited from the site **30** yet), the processor **102** will not count the object **5** into the second accumulated number.

As shown in FIGS. **6** and **7**, when the processor **102** determines that the object **5** moves from the second side S**2** of the gate **300** towards the first side S**1** of the gate **300**, the

processor **102** determines whether the entry position P**1** and the exit position P**3** are located at opposite sides of the entry/exit reference **302** (step S**26** in FIG. **3**). When the processor **102** determines that the entry position P**1** and the exit position P**3** are located at opposite sides of the entry/exit reference **302**, the processor **102** counts the object **5** into the second accumulated number (step S**28** in FIG. **3**). When the processor **102** determines that the entry position P**1** and the exit position P**3** are located at an identical side of the entry/exit reference **302**, the processor **102** does not count the object **5** into the second accumulated number (step S**30** in FIG. **3**).

As shown in FIG. **6**, since the entry position P**1** and the exit position P**3** are located at opposite sides of the entry/exit reference **302** (i.e. the object **5** has exited from the site **30**), the processor **102** will count the object **5** into the second accumulated number. On the other hand, as shown in FIG. **7**, since the entry position P**1** and the exit position P**3** are located at an identical side of the entry/exit reference **302** (i.e. the object **5** has not exited from the site **30** yet), the processor **102** will not count the object **5** into the second accumulated number.

Referring to FIG. **8**, FIG. **8** is a flowchart illustrating an object counting method according to another embodiment of the invention. The object counting method shown in FIG. **8** can be applied to the object counting device **10** shown in FIG. **1**. Except the differences between the steps **16'**, **20'** shown in FIG. **8** and the steps **16**, **20** shown in FIG. **3**, the other steps shown in FIGS. **8** and **3** are substantially identical. Accordingly, only the steps **16'**, **20'** shown in FIG. **8** are described along with FIGS. **4** and **5** in the following.

As shown in FIGS. **4** and **5**, when the processor **102** determines that the object **5** moves from the first side S**1** of the gate **300** towards the second side S**2** of the gate **300**, the processor **102** counts the object **5** into a first accumulated number (step S**16'** in FIG. **8**). In other words, the difference between the step **16'** shown in FIG. **8** and the step **16** shown in FIG. **3** is that the step **16'** shown in FIG. **8** need not record the current position P**2** of the object **5** located at the second side S**2**.

When the object **5** exits from the field of view FOV, the processor **102** records the exit position P**3** of the object **5** (step S**18** in FIG. **8**). Then, the processor **102** determines whether the exit position P**3** is located at the first side S**1** of the entry/exit reference **302** (step S**20'** in FIG. **8**). When the processor **102** determines that the exit position P**3** is located at the first side S**1** of the entry/exit reference **302**, the processor **102** counts the object **5** into the second accumulated number (step S**22** in FIG. **8**). When the processor **102** determines that the exit position P**3** is not located at the first side S**1** of the entry/exit reference **302**, the processor **102** does not count the object **5** into the second accumulated number (step S**24** in FIG. **8**).

As shown in FIG. **4**, since the exit position P**3** is located at the first side S**1** of the entry/exit reference **302** (i.e. the object **5** has exited from the site **30**), the processor **102** will count the object **5** into the second accumulated number. On the other hand, as shown in FIG. **5**, since the exit position P**3** is not located at the first side S**1** of the entry/exit reference **302** (i.e. the exit position P**3** is located at the second side S**2** of the entry/exit reference **302**, so the object **5** has not exited from the site **30** yet), the processor **102** will not count the object **5** into the second accumulated number.

Therefore, according to the object counting methods shown in FIGS. **3** and **8**, the processor **102** may determine whether to count the object **5** into the second accumulated number according to the exit position P**3**.

Referring to FIG. **9**, FIG. **9** is a schematic diagram illustrating an entry/exit reference **302'** according to another embodiment of the invention. As shown in FIG. **9**, the entry/exit reference **302'** is a counting channel, i.e. the entry/exit reference **302'** covers a specific area. The specific area covered by the entry/exit reference **302'** may be determined according to practical applications. In this embodiment, the entry/exit reference **302'** may comprise two boundaries L**1**, L**2**, a first edge E**1** and a second edge E**2**, wherein the first edge E**1** and the second edge E**2** connect the boundaries L**1**, L**2**. When the object **5** enters the entry/exit reference **302'** through any of the boundaries L**1**, L**2**, the first edge E**1** and the second edge E**2**, the processor **102** may set the entry position to be a start point Pa. When the object **5** exits from the entry/exit reference **302'** through any of the boundaries L**1**, L**2**, the first edge E**1** and the second edge E**2**, the processor **102** may set the exit position to be an end point Pb. In this embodiment, the object **5** enters the entry/exit reference **302'** through the first edge E**1** and exits from the entry/exit reference **302'** through the second edge E**2**.

Then, the processor **102** may utilize the boundaries L**1**, L**2** to define a reference axis Ax. In this embodiment, since the boundaries L**1**, L**2** are parallel to each other, the reference axis Ax may be defined as a virtual line intersecting the end point Pb and substantially parallel to the boundaries L**1**, L**2**. Then, the processor **102** calculates a projection length Lp of a moving trajectory of the object **5** within the entry/exit reference **302'** with respect to the reference axis Ax. Furthermore, the processor **102** may take a predetermined proportion of the length of the entry/exit reference **302'** to be a threshold, e.g. the threshold may be 90 percent length of the entry/exit reference **302'**. Then, the processor **102** compares the projection length Lp with the threshold. When the projection length Lp is larger than the threshold, the processor **102** determines that the object **5** passes through the entry/exit reference **302'**. On the other hand, when the projection length Lp is not larger than the threshold, the processor **102** determines that the object **5** does not pass through the entry/exit reference **302'**.

Referring to FIGS. **10** and **11**, FIG. **10** is a functional block diagram illustrating an object counting system **1** according to another embodiment of the invention and FIG. **11** is a schematic diagram illustrating a plurality of object counting devices **10** shown in FIG. **10** being disposed at a plurality of gates **300** of a site **30'**.

As shown in FIG. **10**, the object counting system **1** comprises a plurality of the aforesaid object counting devices **10** and a host device **12**, wherein the host device **12** communicates with the object counting devices **10**. In this embodiment, the host device **12** may be a computer, a server or other electronic devices with data processing/calculating function. Furthermore, the host device **12** may communicate with the object counting devices **10** by wired or wireless manner according to practical applications.

As shown in FIG. **11**, when the site **30'** has a plurality of gates **300**, the invention may dispose a plurality of object counting devices **10** at the gates **300** of the site **30'**. Each of the object counting devices **10** can count objects moving with respect to the gate **300** by the aforesaid object counting method. Accordingly, the host device **12** can receive a plurality of the aforesaid first accumulated numbers and a plurality of the aforesaid second accumulated numbers from the object counting devices **10**. Then, the host device **12** can calculate a first sum of the first accumulated numbers and calculate a second sum of the second accumulated numbers, so as to use the first sum and the second sum to analyze the number of customers who enter or exit from the site **30'**.

As mentioned in the above, when the object in the image sequence passes through the entry/exit reference corresponding to the gate, the invention determines the moving direction of the object first and then determines the timing of counting the object according to the moving direction of the object. Accordingly, the invention can improve the accuracy of counting the number of customers who enter or exit from a specific site (e.g. store, public transportation, etc.) effectively.

Those skilled in the art will readily observe that numerous modifications and alterations of the device and method may be made while retaining the teachings of the invention. Accordingly, the above disclosure should be construed as limited only by the metes and bounds of the appended claims.

What is claimed is:

1. An object counting device comprising:

an image capturer capturing an image sequence related to a gate within a field of view, an object being in the image sequence; and

a processor electrically connected to the image capturer, the processor performing steps of:

determining the object moves from a first side towards a second side of an entry/exit reference corresponding to the gate; counting the object into a first accumulated number and recording a current position of the object, the object being located at the second side and the current position being within the field of view;

determining the object exits the field of view;

recording an exit position of the object, the exit position corresponding to an edge of the field of view;

determining the current position and the exit position are on opposite sides of the entry/exit reference; and

counting the object into a second accumulated number.

2. The object counting device of claim **1**, wherein the entry/exit reference is a boundary line or a counting channel.

3. The object counting device of claim **1**, wherein the processor further performs steps of: determining the object enters the field of view, recording an entry position of the object, determining the object moves from the second side towards the first side of the entry/exit reference, determining the entry position and the exit position are on opposite sides of the entry/exit reference, and counting the object into the second accumulated number.

4. The object counting device of claim **1**, wherein the processor further performs steps of: making a mark to indicate that the object has been counted into the second accumulated number when the processor counts the object into the second accumulated number.

5. An object counting system comprising:

a plurality of object counting devices, each of the object counting devices comprising:

an image capturer capturing an image sequence related to a gate within a field of view, an object being in the image sequence; and

a processor electrically connected to the image capturer, the processor performing steps of:

determining the object moves from a first side towards a second side of an entry/exit reference corresponding to the gate;

counting the object into a first accumulated number and recording a current position of the object, the object being located at the second side and the current position being within the field of view;

determining the object exits the field of view;

recording an exit position of the object, the exit position corresponding to an edge of the field of view;

determining the current position and the exit position are on opposite sides of the entry/exit reference; and

counting the object into a second accumulated number;

a host device communicating with the object counting devices, the host device receiving a plurality of the first accumulated numbers and a plurality of the second accumulated numbers from the object counting devices, calculating a first sum of the first accumulated numbers, and calculating a second sum of the second accumulated numbers.

6. The object counting system of claim **5**, wherein the entry/exit reference is a boundary line or a counting channel.

7. The object counting system of claim **5**, wherein the processor further performs steps of: determining the object enters the field of view, recording an entry position of the object, determining the object moves from the second side towards the first side of the entry/exit reference, determining the entry position and the exit position are on opposite sides of the entry/exit reference, and counting the object into the second accumulated number.

8. The object counting system of claim **5**, wherein the processor further performs steps of: making a mark to indicate that the object has been counted into the second accumulated number when the processor counts the object into the second accumulated number.

9. An object counting method comprising steps of:

capturing an image sequence related to a gate within a field of view, an object being in the image sequence;

determining the object moves from a first side towards a second side of an entry/exit reference corresponding to the gate;

counting the object into a first accumulated number and recording a current position of the object, the object being located at the second side and the current position being within the field of view;

determining the object exits the field of view;

recording an exit position of the object, the exit position corresponding to an edge of the field of view;

determining the current position and the exit position are on opposite sides of the entry/exit reference; and

counting the object into a second accumulated number.

10. The object counting method of claim **9**, wherein the entry/exit reference is a boundary line or a counting channel.

11. The object counting method of claim **9**, further comprising steps of:

determining the object enters the field of view;

recording an entry position of the object;

determining the object moves from the second side towards the first side of the entry/exit reference;

determining the entry position and the exit position are on opposite sides of the entry/exit reference; and

counting the object into the second accumulated number.

12. The object counting method of claim **9**, further comprising step of:

making a mark to indicate that the object has been counted into the second accumulated number when counting the object into the second accumulated number.

13. The object counting method of claim **9**, further comprising steps of:

receiving a plurality of the first accumulated numbers and a plurality of the second accumulated numbers; and

calculating a first sum of the first accumulated numbers and calculating a second sum of the second accumulated numbers.

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